MICROFACIES AND DEPOSITIONAL ANALYSIS OF THE MISHRIF FORMATION IN SELECTED WELLS OF RATAWI OILFIELD, SOUTHERN IRAQ

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Microfacies and depositional analysis of the mishrif

Formation in selected wells of zubair oilfield, Southern iraq

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ABSTRACT

This research includes evaluating the microfacies of the Mishrif limestone formation in wells of the Zubair field (Zb-199, Zb-43, Zb-47,Zb-114). This study is depending on the biological content by analyzing the thin slices, six major facies and ninteen secondary facies were identified (Wackstonemicrofacies,Wackstone-packstone Microfacies,packston Microfacies,packston-Grainstone Microfacies, Grainstone Microfacies) The main skeletal grains of the Mishrif formation include coral, Rudist, large and small benthonic Foraminifera & planktonic Foraminifera (Planktonic Foraminifera are common in the lower part of the Mishrif Formation), ostracods, echinoderms, and molluscs. The Rudist were found in small to large fragments The Non-skeletal grains included peloids.

The most important diagenetic processes affecting on the Mishrif Formation are dolomitization,dissolution,cementation,micritization,recrystallization and compaction.Mishrif succession comprises six paleoenvironments which, shallow open marine, rudist biostrome, shoal, back shoal, and lagoon.The dominant pore types are vuggy, interparticle , intercrystal and moldic.

INTRODUCTION

The Mishrif Formation is considered one of the formations of the secondary sedimentary cycle (Late Cenomanian - Early Turonin) and one of the most important reservoirs in the Mesopotamian Basin in central and southern Iraq. Production began in the Mushrif reservoir of the Zubair oil field in 1965 through the Zubair-32 well.. This study came to complement the previous studies in the Zubair field, which is one of the giant oil fields after Rumaila and West Qurna in the southern region of Iraq and to give a clear image of the sedimentary facies and the changing environments of formation. The Mishrif Formation in the Zubair oil field is one of the

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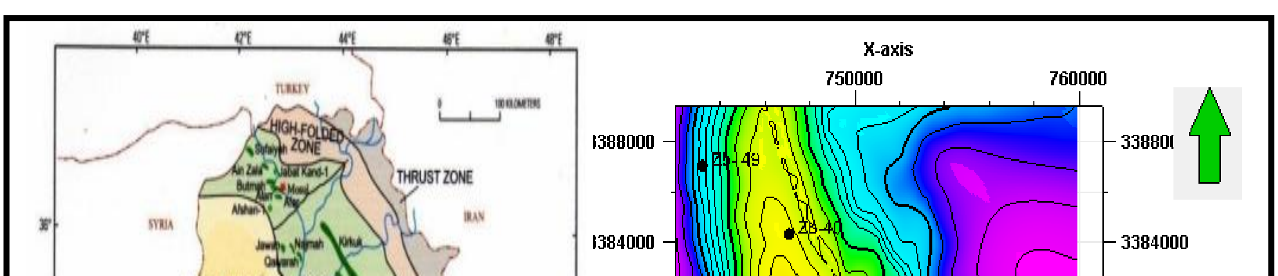
main formations produced in the field (ZFOD, 2016).Its carbonate rocks are characterized by vertical and lateral heterogeneity, and the contrast and complexity poses a challenge to understanding the sedimentary model and facies distribution,by interpreting and analyzing the core and rock slices under the microscope to identify the micro facies and the diagenetic processes affecting their impact on the properties of the reservoir rocks, determining the sedimentary environments, , then this section is divided into a number of major and secondary facies according to the divisions (Wilson, 1975) and distributed within their environments for the purpose of benefiting from them in the end in drawing the sedimentary model of the formation in the study area. This study aims to study the microfacies, depositional environments, and diagenetic processes affecting the facies of the Mishrif Formation in the Zubair oil field in southern Iraq.The formation of the mishrif has been subject to many studies due to its economic importance, Al-Jumaili (2001) studied the facies and sedimentary environment and the stratigraphic sequences of the Mishref formation in central and southern Iraq. The formation was divided according to the facies and the environment into the facies of the basin environment and the open sea environment, Razuyan (2002) deduced a taxonomic system specific to the microfacies architecture of carbonate rocks that included (17) sedimentary and metamorphic facies with three groups of dysfacial facies (Arch. I, II and III) for the Mishrif Formation in the North Rumaila and West Qurna fields, . Handal (2006) conducted a study on the physical properties of the Mishrif formation in Nasriyah field, as well as calculating the recoverable oil reserves in the field, and it found an improvement in the reservoir properties towards wells Ns-4 and Ns-5, Al-Maliki (2009) showed by examining the diagrams that the Mishrif formation in the West Qurna field consists of five main facies and sixteen secondary facies in a wide range of shallow facies, Al-Najm (2013) studied the development of the Mesopotamian basin and the reservoir specifications for the formation of Mishrif in selected fields in the south and southeast of Iraq,Al-Ali (2019) shows the relationship between the diversity of fossils and the petrophysical specifications in the Mishref formation in the northern Rumaila field in southern Iraq and concludes that the fossils are evidence of improvement or poor petrophysical specifications.

STUDY AREA

The Zubair oil field is located in the southwestern part of Iraq, 20 km west of Basra. The field is located approximately between (47° 32' 47° 45') latitude and (30° 05' 30° 42') longitude as shown in (Fig. Safwan and its axis extend towards (Northwest - Southeast) parallel to the axis of the Rumaila field, extending from the Iraqi-Kuwaiti fields to the marshes region in the north (ZFOD, 2016). From the west, the Rumaila oil field, and from the south, the Kuwait border with Iraq Figure (1)



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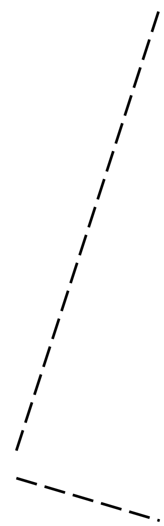

Figure (1): map of Iraq showing the study area

STRATIGRAPHIC SETTING

According to the tectonic subdivisions of Iraq, the Zubair oil field is located in the Mesopotamian range which is part of the stable platform and specifically in the Zubair secondary tectonic belt (Zubair sub-area) (Aqrawi, 2010). The Mishrif Formation is located within the (Cenomananian-early Turonian)cycle, which represents the second sedimentary cycle of the previously called Middle Cretaceous succession deposited in the Mesopotamian basin in southern and central Iraq. The bottom is the Rumaila Formation, where the contact is gradual, which sometimes makes it difficult to distinguish between the rock units of these two formations. Figure (2).

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Age		Group	Formation	Lith.	Description
period	epoch				
Tertiary	L. Miocene -Recent	Kuwait	Q. deposits		Clay and silt
			Dubbdiba		Sand and gravel
	E- M Miocene		Fatha		Marl and limestone
			Ghar		Sand and gravel
	M-L Eocene	Hasa	Dammam		dolomite
	Paleocene- early Eocene		Rus		Anhydrite
			Umm-Radhuma		dolomite
Cretaceous	Late cretaceous	Aruma	Tayarat		dolomite
			shiraish		Marly limestone
			Hartha		Limestone and dolomite
			Sadi		Limestone
			Tanuma		Shale
			Khasib		Limestone
	Middle cretaceous	Wasia	Mishrif		Limestone
			Rumaila		Limestone
			Ahmadi		Limestone
			Mauddud		Limestone
			Nhr Umar		Sand and Shale
	Early cretaceous	Thamama	Shuaiba		Limestone and Dolomite
			Zubair		Sand and Shale

			Ratawi		Limestone with Shale
			Yammama		Limestone
Jurassic	U-Jurassic		suly		Argillaceous Limestone

Figure (2): Stratigraphic column in the south of Iraq (work of authors based on data form the Basrah Oil Company).

Material and methods

As a main part of this study, 300 thin sections of limestone samples from the Mishrif Formation were inspected In the study, it relied on Dunham (1962) to classify limestone rocks in the analysis of fine facies Figure (3) and processes of diagenesis. The allochemical constituents were identified using the skeletal and nonskeletal grain .

through the data obtained from the detailed study of more than (300) rocky slices of Formation Al-Mishrif, with one slice or more for meter using a polarizing microscope to determine the texture and microfacies and to classify the components ,the formation microfacies were determined and compared with the Standard microfacies (SMF) which were determined by (Wilson (1975) And then linking it to the facies identified by Flugel, (1982) Figure (4), which was used to explain the sedimentary facies and their distribution and to know the sedimentary environments of the study area and their vertical and lateral changes

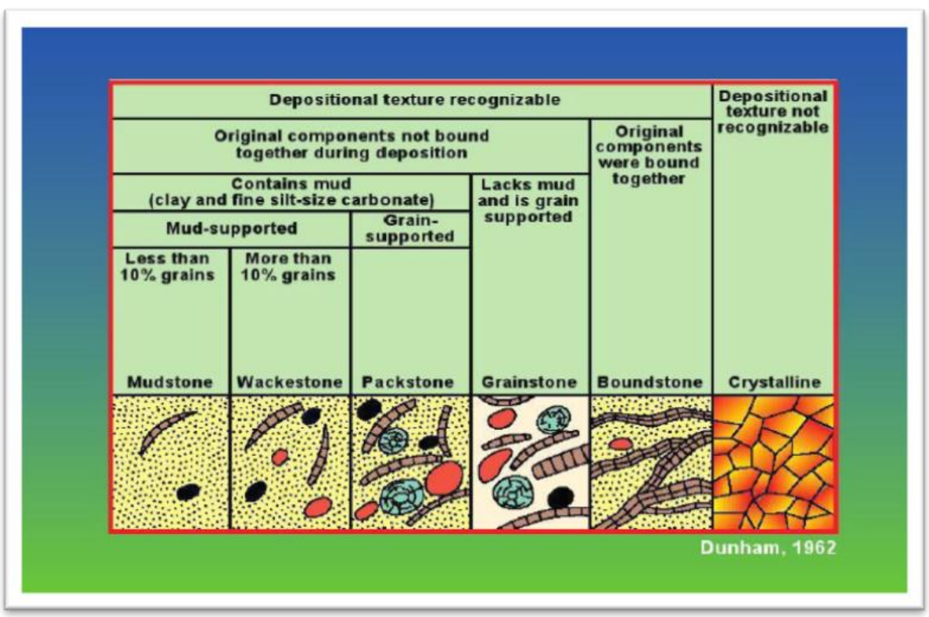

Figure (3) shows the Dunham classification (Dunham, 1962) for limestone

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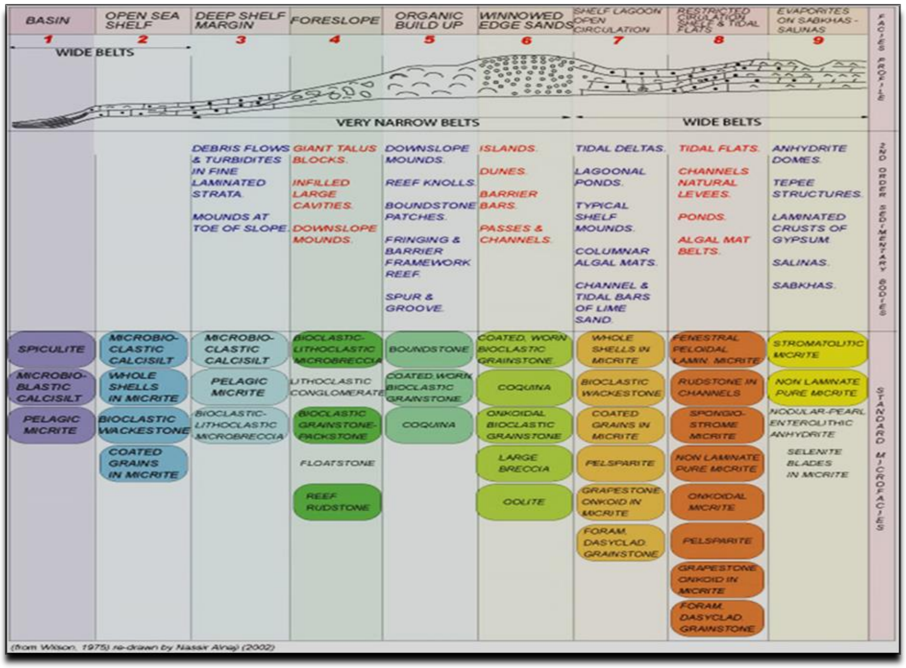

Figure (4) : Wilson (1975) Micro-Facility Distribution Model

Petrographic constituents to microfacis

Ground mass

The Ground mass consists mainly of micro crystalline calcite, which is called (Micrite), which is small crystals with a diameter of not more than 4 microns and often appear darck under the microscope. The ground is one of the most important indicators that determine the intensity of the sedimentation energy, as (Micrite) is deposited in an environment with quiet sedimentation energy, while Calcite sparry is deposited in an environment with high sedimentation energy (Flugel, 1982).

Grain Particales

The grains in limestone are divided into two types: skeletal grains and non-skeletal grains. The following is a review of the most important components of the grains.

- Skeletal Grains: which include:

Foraminifera .

Foraminifera are found in all marine environments, which can be large or small benthic foraminifera or floating foraminifera, and their great abundance has environmental implications, as the foraminifera of shallow and deep marine environments are widely available in most of the study wells, which generally include:Miliolids , Nezzazata , Textularia , Rotalina , Praealeveolina, Cislaveolina , Ovalveolina , Alveoliidae , Qataria , Cycledomia ,

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Pseudotextularia , Pseudolituonella , Orbitolina , Chrysaldina ,and Planktonic Foraminefra. This is in addition to the presence of other types of benthic foraminifera, but to a lesser extent. Environmental factors such as depth, temperature, salinity, waves and currents control the distribution and development of organisms in diverse environments (Tucker, 1985).

Other Organisms

Several other skeletal granules appear in the Mishrif facies such as Echinoderm and Bioclastic fragments, as well as fragments of algae represented by the Permocalculus fragment specific to the shallow marine environment. There are also sponges spicules, which refer to a quiet environment, and pieces of rudist appeared in the form of pieces of large to medium-sized biota, and the formation facies contain pieces and fragments of Mollusca, which are found in the form of pieces of Pelecypods shells And the gastropod as a result of the influence of high current energy, as well as stellate shells and pieces of corals, which are found in a small percentage, where most of them are found in the form of bioclastic crumbs, and they are found in almost most facies and in varying proportions depending on the sedimentary environment.

- Non-Skeletal Grains

The non-structural granules that were observed in the composition of the mishrif for the peloids

Peloids

They are in the form of spherical or oval-shaped granules, and they are widespread in most study wells, with a diameter ranging from (1-0.2) mm, with out internal structures and of regular sizes and shapes. They are common in shallow seas, coral reefs and muddy mounds (Flugel, 2004).

RESULTS AND DISCUSSION

Microfacies and their types

Based on the presence of grains relative to the rocky mortar, (7) major facies were diagnosed, and each of these major facies was divided into nineteen secondary facies as follows: -

1- Wackstone microfacies

This facies is one of the most common facies of the section under study. This facies mainly consists of a micrite base with skeletal and non-skeletal granules whose percentage ranges from more than (15%) and the structural components present are the benthic and floating foraminifera, echinoderms, mollusks and algae. This facies were effected by a number of diagenesses processes such as dissolution, micritization, compaction, dolomiteization and cementation, depending on the environmental conditions prevailing at the time of deposition. It was also noted that the porosity varied in this facies according to the severity of its impact on the

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transformational processes. This facility is characterized by high porosity with the presence of oil evidence, which indicates that it is a good reservoir facies, and among the diagenesses processes that were observed in it are the process of new formation and the process of compression, as it is noted the prevalence of solvation solutions (Stylolite) and the process of cementation, which was represented by several types of them Granular Cement and Blocky Cement. This facies were diagenosed in all wells of the study, as they spread widely in the Mishrif formation and in the first and second reservoir units. It has been possible to distinguish (5) secondary facies belonging to this type of main facies, depending on dominance of the skeletal grain inthis facies as follows:

a- Benthonic foram wackestone submicrofacies

This secondary facace is characterized by the predominance of skeletal granules represented by benthic foraminifera and some genera of the family Miliolidae as well as the presence of fragments of Echinoid Mollusca. This facies spread in most of the wells of the study area, where it is located within the second reservoir unit. When comparing this facies with the standard facies defined by Wilson (1975), it was found that it is similar to the standard facies (SMF-9) within the (FZ-7) deposited in a lagoon environment.

b -Bioclastic Benthonic and Planktonic Foram wackestone submicrofacies

This facies is characterized by the predominance of the bioclastic and floating fossils of the granular components, and it is one of the complex facies found in the Mishref formation due to its strong impact on the processes, as it shows the severity of the effect of the dissolution process for the soft bioclasticl fractures forming an open pattern of porosity, plate (1-b). When comparing this facies with the standard facies, we find that it is located within the (SMF-9) facies within the (FZ-7) range and is deposited in an open lagoon environment of marine open towards the open sea.

c- Algae wackestone submicrofacies

This facies is characterized by the presence of pieces of algae of the genus (Permocalculu ampullecaus) and this facies are more affacted to the process of differential dissolution forming moldic porosity, and one of the diagenessies processes affecting this secondary facies is cementation and granulation Plate(1-c). When comparing this facies with Wolsen facies, it was found that it represents the standard facies (SMF-12) located within the range (FZ-7).

d- Peloidal wackstone submicrofacies

This facies is characterized by the presence of peloidal of different sizes in a micrite base, with a few different bioclastic debris This facies is effected by various diagenessis processes such as dissolution and micritation (plate 1-e).

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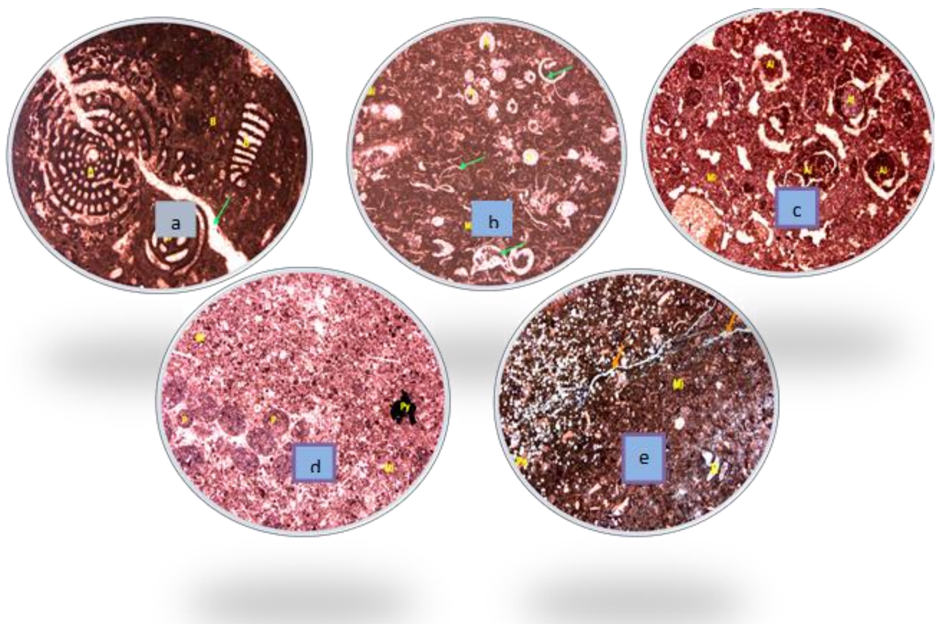
e- Dolomitizatied bioclasticWackeston submicrofacies

The granules of this facies consist of the bioclastic detritus of mollusc shells and Echinoids as well as coral fractures and other bioclastic immersed in the middle of a fine spar floor. The dolomitzation process is one of the most important diagenessies processes effecting this facies, and this facies is affected by both the processes of dissolution and recrystallization (Palette d-1). When comparing this facies with the standard facies, it was found that it represents the facies (SMF-14) deposited in the facies zone (FZ-4).

plate(1)



a-Benthonic foram wackestone submicrofacies (Miliolida, Ovalveolin, Nezzazate,)in well Zb-47 of depth (2295.74m),
b-Bioclastic Benthonic and Planktonic Foram wackestone submicrofacies in well Zb-199 (2242.85m),
C-Algae wackestone submicrofacies in the well (2366.45m) Zb-43,
d-Peloidal wackstone submicrofacies in well Zb-199 (242.85m),
e- Dolomitizatied bioclasticWackeston submicrofacies in well Zb-199 (2306m)

2-Wackestone-Packstone Microfacies

This facies mainly consist of skeletal and non- skeletal grains at an estimated rate of (70%),that the largest presence of this Mud supported, the largest presence of this facies is in the well(Zb-47)plate (2). It has been possible to divide this facies into (3) secondary facies depending on their granular components.

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a-Peloidal and Bioclastic Planktonic foram Wackestone – Packstone Submicrofacies
This facies consist of a high percentage of peloidal and bioclastic fragments and there is a quantity of benthic and floating foraminifera within its sediments. The floor of this facies is composed of micrite, which sometimes fine spars. Plate (2-a) Specifications of this microfacies were compared with the facies of Wilson (1975). It was found that it is comparable to the standard facies (SMF-18), which is within the facies range (FZ-8).

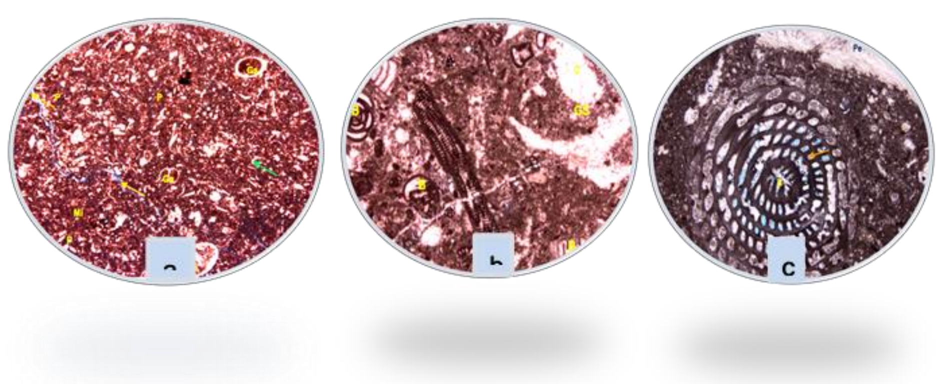
b- Benthonic Foraminifera Wackestone-Packstne Submicrofacies

It is characterized by the predominance of the skeletal granules represented by the benthic foraminifera represented by the genas (Miliolids, Nezzazata , Echinoderms, Pelecypods, Calcispheres, Praealeveolina , Textularia Rotalina), as well as pieces of rudiste and echinoderms and some of the organisms. Size with some small sized granules having little spread within the facies plate (2-b). The specifications of this fine facies were compared with the standard Wilson (1975) facies, and it was found that they are comparable to the standard facies (SMF-18), which are located within the facies range (FZ-8) represented by the Lagoon environment.

c- Planktonic Foram Wackestone –Packstone Submicrofacies

This facies is commonly composed of abundant planktonnic foraminifera represented by the genas(Heterohelix, Hedberella, Oligostegina, Globotruncana, and bioclastic pieces of rudist as well as benthic foraminifera.(2 -c). The specifications of this fine facies were compared with the standard facies of Wilson (1975) and it was found that they are comparable to the standard facies (SMF-3), which fall within the facies range (FZ-3) represented by the environment. Regarding the characteristics of the reservoir facies, it is considered acceptable in some depths to poor in reservoirs depending on the type diagenesses processes effecting it.

Plate (2)



a-Peloidal and Bioclastic Planktonic foram Wackestone – Packstone Submicrofacies ,zb-199 depth(2280m)

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b- Benthonic Foraminifera Wackestone-Packstne Submicrofacies, Zb- 43 depth (2356.95 m).

c- Planktonic Foram Wackestone –Packstone Submicrofacies, Zb-47, depth(2439.04 m)

3-Packstone Microfacies

This type of facies is characterized by a high percentage of grains and pores ranging between (70-90%), while the base constitutes the remaining percentage. relatively the largest spread of it is within the well (Zb-119) (panel 3)It has been possible to divide this facies into (4) secondary facies depending on the type of grains prevalent in them.

a his facies characterized by higher their content of bioclastic and mainly from benthic foraminifera and rudist pieces of molluscs and echinoderms as well as a small of peloidal and benthic foraminifera and planktonic. This facies is characterized by medium to small granules of plate (3-a) size. The specification of this fine facies was compared with the standard Wilson facies (1975) and it is comparable to the standard facies (SMF-4) which within the range (FZ-4)

a- Bioclastic and Planktonic Foram Packstone Submicrofacies

This facies is characterized by its high content of bioclastic mainly from benthic foraminifera, pieces of rudist, and pieces of mollusks and echinoderms, as well as a benthic and planktonic foraminifera. This facies is characterized by medium to small grainules size plate (3-a)The specification of this microfacies was compared with the standard Wilson (1975) facies and it was found that it is comparable to the standard facies(SMF-4) which fall within the fractal range(FZ-4)

b- Peloidal and Bioclastic Packstone Submicrofacies

This facies consist of a high percentage of peloidal and bioclastic fragments represented by cephalopods, pieces of foraminifera plate (3-b). This type of secondary facies is formed under a special environment represented by the depositional energy and the medium wave movement responsible for washing the clay materials and the micrite base. The specifications of this fine facies were compared with the standard Wilson (1975) facies and it was found that they are comparable to the standard facies (SMF-16) which are within the facies range (FZ7-8) represented by the shallow lagoon environment.

C- Benthonic Foraminifera Packstone Submicrofacies

his facies is characterized by containing a high percentage of skeletal granules represented by the benthic foraminifera, as well as a percentage of bio-clastic plate(3-c). The specification of this fine facies was compared with the standard Wilson (1975) facies and it was found that it is comparable to the standard facies (SMF-18) which fall within the fractal range (FZ7-8). Represented by the environment of isolated lagoon lakes or shallow coastal lagoons with open circulation, but from the point of view of the reservoir, this facies is of good reservoir capacity.

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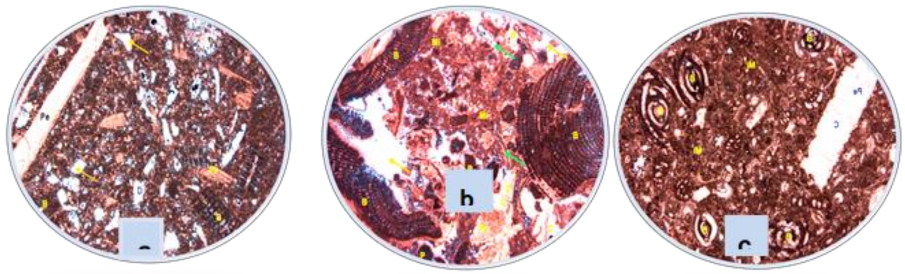
plate(3)

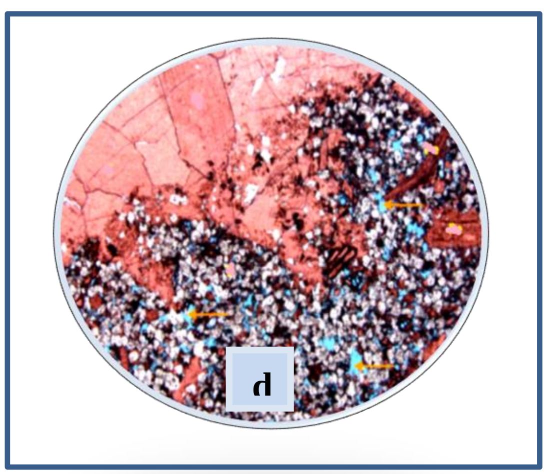


a- Bioclastic and Planktonic Foram Packstone Submicrofacies in well Zb-47 (2378.09m),

b- Peloidal and Bioclastic Packstone Submicrofacies in well Zb-43 (2366.45m)
C- Benthonic Foraminifera Packstone Submicrofacies in well Zb-47 (2311.38 m)

d- Dolomitizatied Benthonic Foraminifera Packstone Submicrofacies

This facies is characterized by containing a percentage of skeletal granules such as benthic foraminifera and a high percentage of biological fragments, and the dolomite process is one of the most important transformational processes effecting this facies. When comparing this facies with the standard facies, it was found that it represents the (SMF-14) facies deposited in the facies zone (FZ-4) indicative of the slope environment.



d- Domitizatied Benthonic Foraminifera Packstone Submicrofacies in well 40Zb- ((2296.36m))

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4- packstone – Grainstone microfacies

This facies is characterized by the predominance of grains that are stacked on each other in a ground of fine and false calcite, and the presence of micrite is less. Fossils of benthic foraminifera constitute a high percentage of the components of this facies, in addition to the presence of biofoulings and peloidal plates (4). This facies represent the shoal environment and high-energy environments. The largest spread of it is in the Zb-47 well. Depending on the proportions of the presence of skeletal and non- skeletal grains, this facies can be divided into two secondary facies.

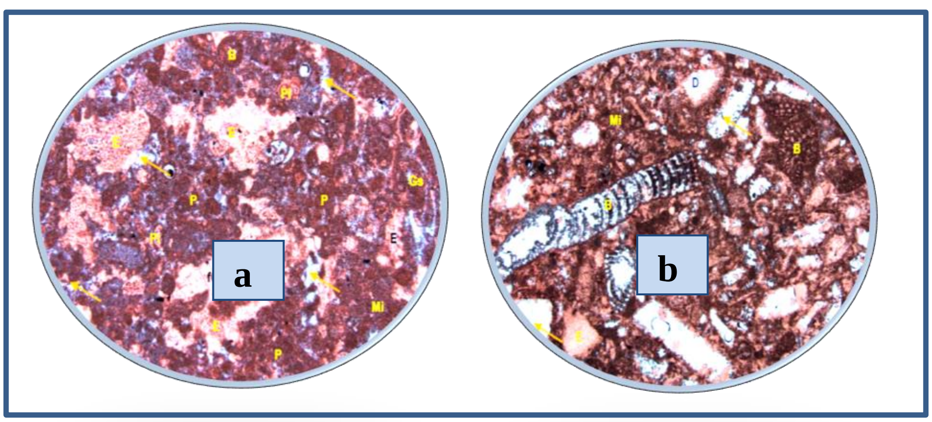
a- Peloidal pack stone – Grain stone submicrofacies

This facies mainly contains peloidal, which is characterized by being well sorted due to the high energy of the waves, and it is characterized by the presence of high porosity, as the cement is micrite partially transformed into spiraite(4-a)). When compared to the standard facies, it falls within the SMF-15 facies in the FZ-6 range, indicating the environment of shoale.

b- Benthic foram packstone – grainstone submicrofacies

This facies is characterized by its proximity to the shells rudiste, algae and some foraminifera benthic of (Cycledomia) as well as the presence of peloidal as these facies contain crystals of large dolomite faceted and high crystallization as well as containing porosity moldic and porosity (Vuge) and porosity between the crystals in addition to solutions Dissolving plate (4 -b), and this facilitation is rare in the wells study. When comparing this facies with standard facies, it was facies that it is similar to (SMF-12) facies within (FZ-6) range, and it is a good reservoir facies.

Plate (4)



a-Peloidal pack stone – Grain stone submicrofacies in the well (2369.45m) Zb-43,

b-Benthic foram packstone – grainstone submicrofacies in well 47Zb- (2320.38 m)

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5-Grainstone Microfacies

This facies is characterized by the abundance of grains that lean on each other in a floor of fine and false calcite, and there is no migraine, and there is no micrite. Fossils of the benthic foraminifera constitute a high percentage of the components of this facies, in addition to the presence of bioclastic and peloidal. This facies can be counted within the environment Shoals and high energy environments. Depending on the proportions of the presence of skeletal and non- skeletal grains, this facies can be divided into three secondary facies.

a- Peloidal and Benthonic Foaminifera Granstone Submicrofacies

The peloidal and benthic foraminifera constitute a very high percentage of this facies, and the graines of this facies are of medium to large size as well as pieces of Echinoid or Mollusca plate (5-a). From the comparison of the specifications of this micrite facies with the standard facies Wilson (1975) it was found that it is comparable to the standard facies (SMF-11), which is located within the facies range (FZ-6) representing the shallow environment and the shallow open sea.

b- Peloidal Grainstone Submicrofacies

This facies is characterized by the predominance of non-skeletal grainular represented by the peloides resulting from the micritzation process to which the skeletal graines are exposed. The specifications of this microfacies were compared with the standard facies of Wilson (1975) and it was found comparable to the standard facies (SMF-11) which is located within the facies range (FZ-6) represented by the shallow environment and the shallow open sea.

c- Benthonic Foraminifera Grainstone Submicrofacies

This facies mainly consists of skeletal graines represented by the benthic foraminifera, as well as the bioclastic (Plate 5-c). The specifications of this microfacies were compared with the standard facies of Wilson (1975) and it was found that they are comparable to the standard facies (SMF-18), which are located within the facies range (FZ-7) represented by the environment of shallow lagoons with open circulation.

plate(5)

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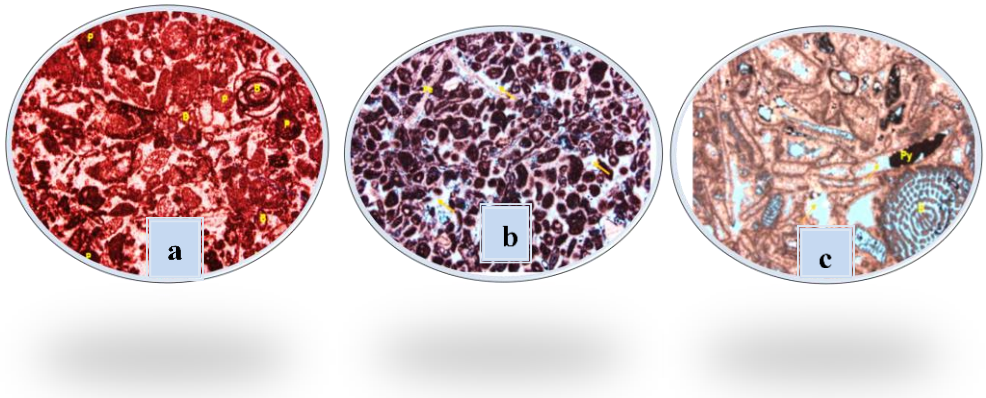

a- Peloidal and Benthonic Foaminifera Granstone Submicrofacies in well Zb-47 (2231.93m)

b- Peloidal Grainstone Submicrofacies in well Zb-49 (2479.22m)

c- Benthonic Foraminifera Grainstone Submicrofacies in well Zb-43 (2361.7m)

6- Boundstone Microfacies

This facies consists of a high abundance of mollusks and rudist pieces. It also contains coral nuts of smaller size plate (6-a). This facies is an important that is indicative of a high energy environment ,it is characterized by high primary and secondary porosity and high permeability, and therefore it is considered one of the most important reservoir units in the Mishrif formation.

7- Dolostone Microfacies

This facies contains very fine rhombic crystals, which represent the early dolomite stage. In other parts we notice dolomite diamonds grow larger to become large and full-faceted, and this represents the late dolomite stage, forming this transformative facies resulting from the severe dolomitic process, which changed the original texture of the rock It is difficult to identify the quality of the original texture of the rock in those parts. This facies is one of the modulatory facies with limited and little spread in some wells, such as the Zb-40 well, and it has a wider spread in other wells, as in the Zb-119 well. From the point of view of the this facies is considered poor reservoir plate (6-b).

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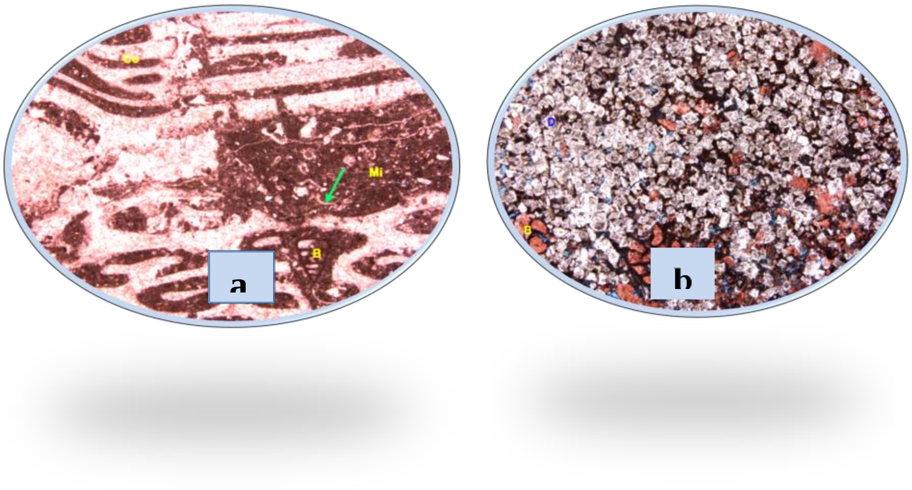

a- Boundstone Microfacie s Zb-199 (2449.53m) ,

b- Dolostone Microfacie Zb- 43 (2441.75m.).

- Depositional enviroment

According to the description of the fine sedimentary facies and their variance sideways and vertically due to their different environments, the Mishref formation environments in the West Zubair Oil Field can be divided into six environments as shown in Figure (6), and these environments are

1- Open marine Environment(mid ram)

It represents a transitional environment between the facies of the Mishrif and Rumaila formations, in which sediments are abundant in the deep areas. Among the microfacies characteristic of this sedimentary environment are the facies of muddy and wackestone and bearing floating foraminiferous and bioclastic fragments and deposited within the facies zone(FZ-3) according to Classification Flugel (1982) It is the beginning of the first retrograde sedimentary cycle of the Lower mishrif Formation that began with deep basin deposits supported by our mud. The most important characteristic of this facies is that it is deposited in a relatively deep environment, with a quiet sedimentation energy, which characterized this facies mainly in the lower part of the mishrif formation in the study wells, as well as in the areas separating the reservoir units Moderate depending on the type and severity of the Diagenetic processes.

2- Foreslop Environment

The facies of this environment consist of limestone wacke and wacke packstone containing fragments located between the facies of the open sea and the facies of the shallow environment. The facies of this environment are characterized by a small thickness and intermittent extension. The facies begin to shalloing upwards. The facies of this environment are

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deposited with wackestone facies containing shell ofbioclastic, echinoderms, benthic foraminifera, algae and rudist pieces. When comparing the facies of this environment with Wilson (1975) it was found that facies zone (FZ-4).

3- Rudist Bioherm Environment

The facies of this environment are characterized by the presence of large-sized pieces of rudist fractions deposited in facies ranging from packstone faciesto granular and rudist limestone with little algae and corals. The facies of this environment are also classified as the best sites of saturation with hydrocarbons because they have a high primary porosity affected by the secondary dissolution process that leads to the development of primary porosity. SMF-5-6 in (FZ-5)).

4- Shoal Environment

This environment is characterized by the facies of fine-grained and packstone rich in bioclastic pieces and the facies peloidal packstone within the range(FZ-6) which is the extension of the facies to the environment of the rudist reefs. . This environment marks the end of the first retrograde cycle of mishrif formation.

5- Lagoon Environmnet

The main components of this environment are the facies of wacke and wackepackstone containing large benthic foraminifera and packestone containing bioclastic, as well as the facies of peloidal packstone. The facies in this environment fall within the facies range (FZ-7) (Flugel, 1982) of the standard facies (SMF-9) Wilson, 1975) and this environment is found in the upper and middle part of the Mushrif Formation, and the facies of this environment represent the conclusion of the sedimentation sequence of the Mushrif Formation and the beginning of the kasib sedimentation.

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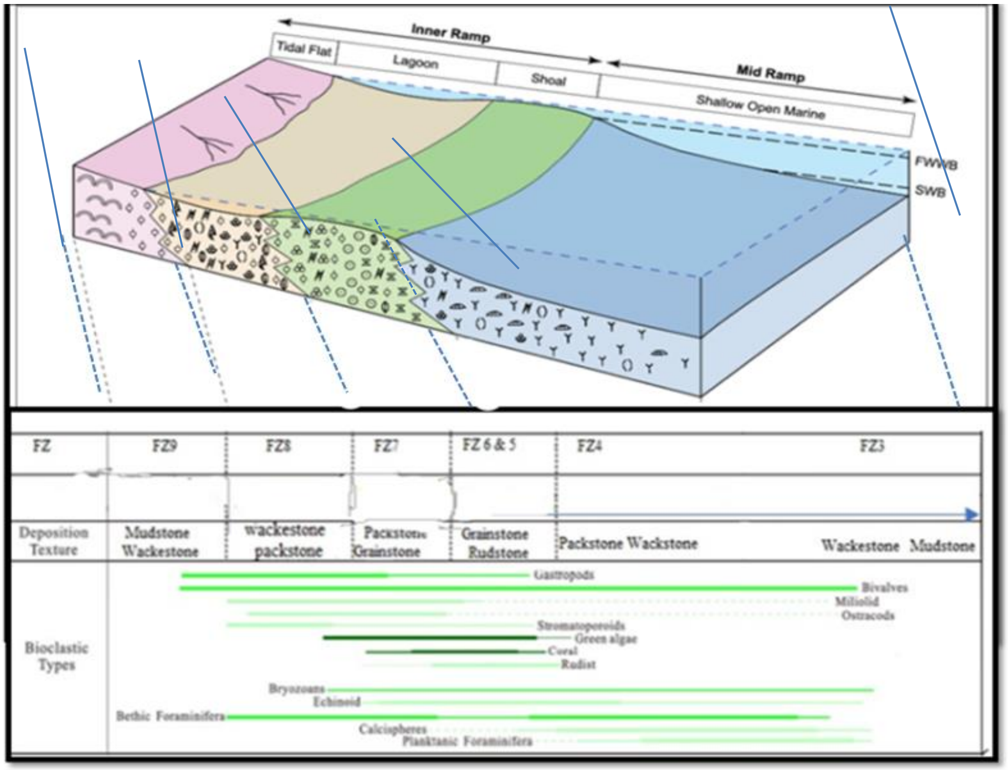
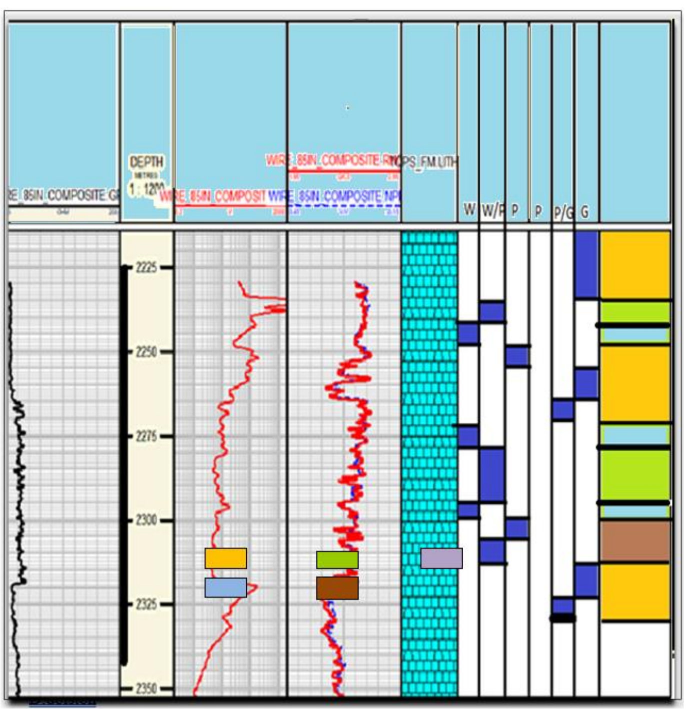


Figure (4) :**Model deposition of supervisor formation in Zubair field**



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w/p:wackston packston Shoal lagoon for slop

p:packston open marin bioherm

p/G:packston grainston

G:grainston

D:dolston

Figure (5): Distribution of facies and depositional environments versus probes in the well Zb-47

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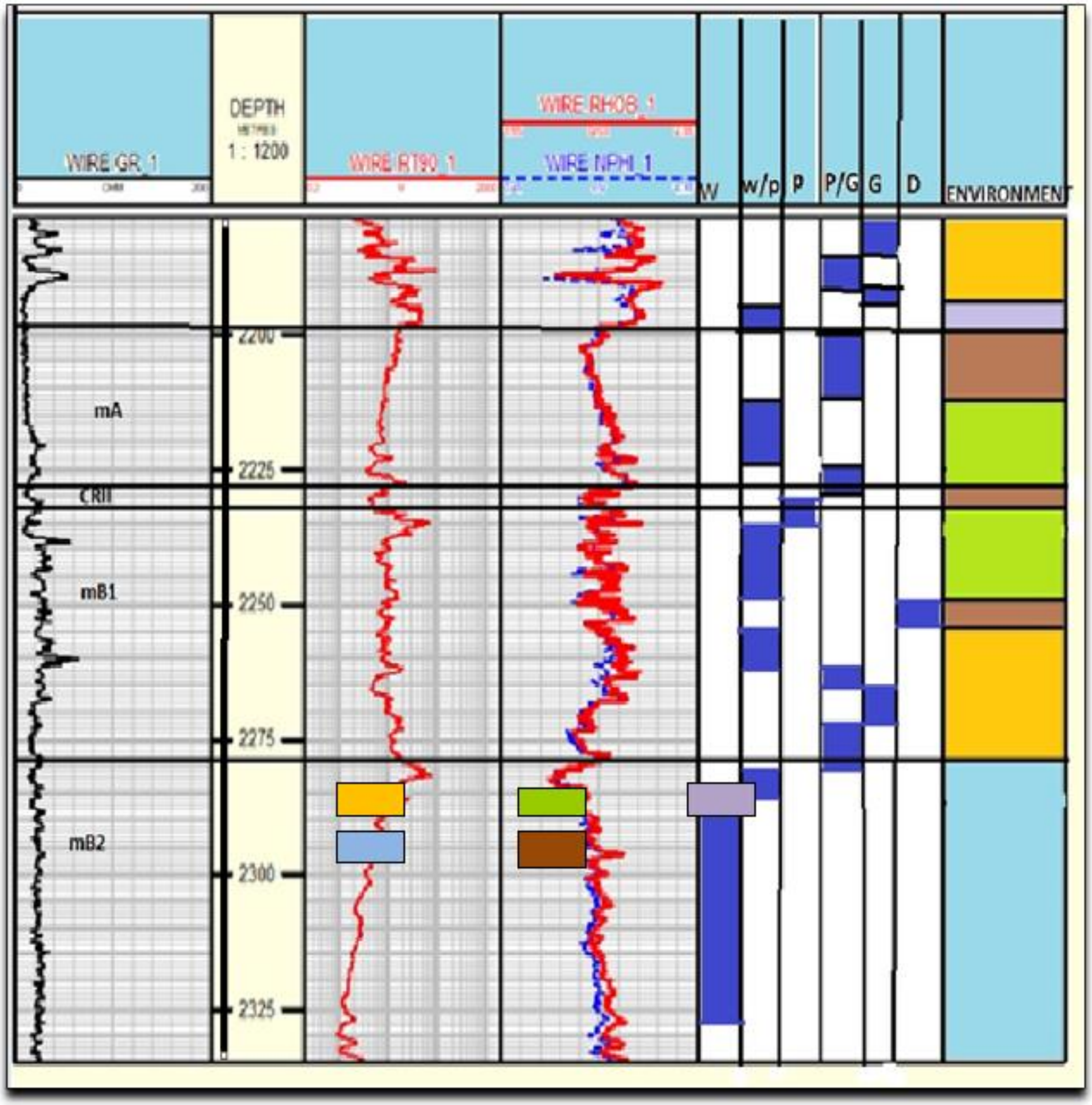

w/p:wackston packston   Shoal   lagoon   for slop

p:packston   open marin   bioherm

p/G:packston grainston

G:grainston

D:dolston

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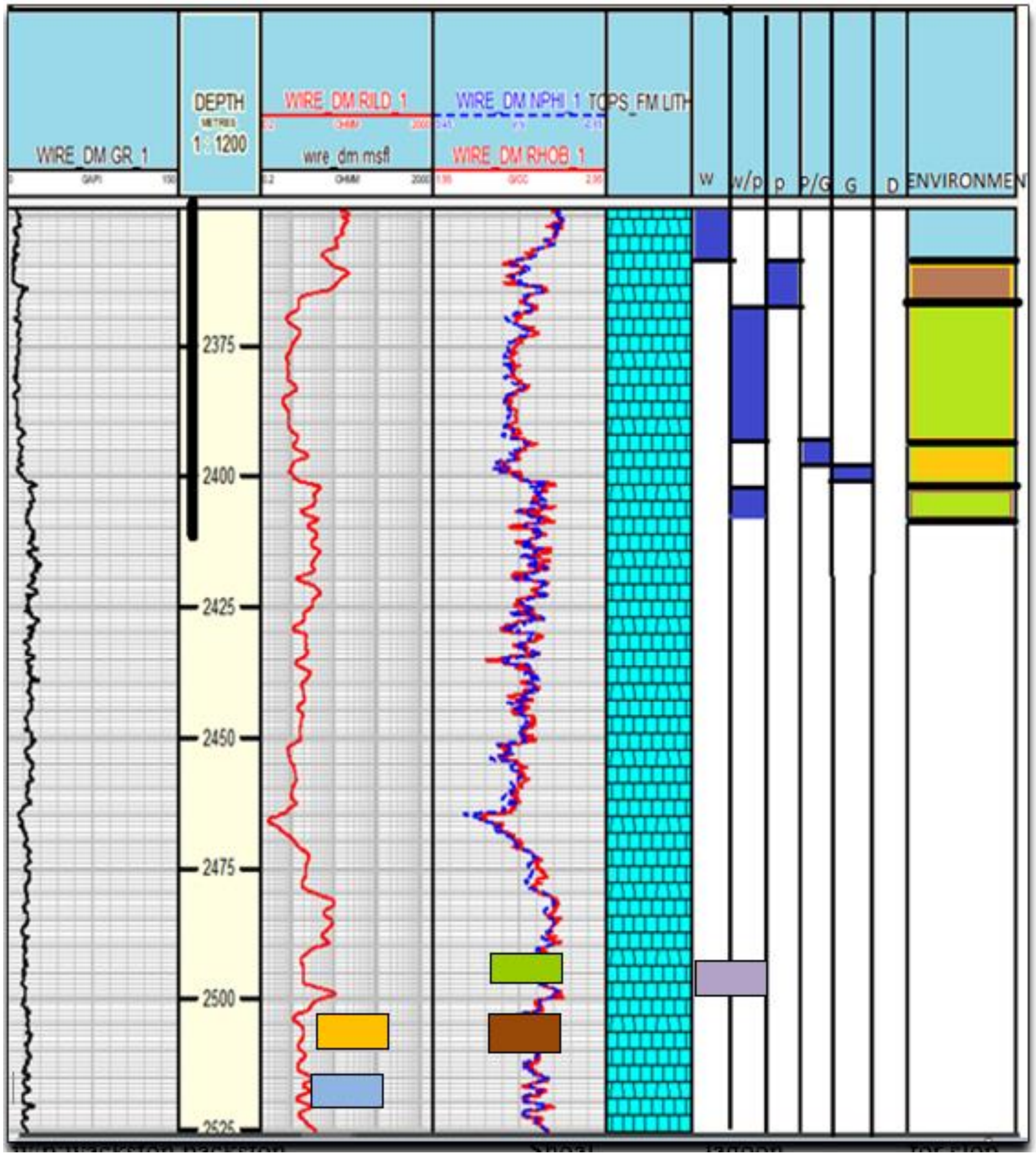
Figure (6): Distribution of facies and depositional environments versus probes in the wellZb-199



w:wakeston

w/p:wackston packston

p:packston

p/G:packston grainston

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w/p:wackston packston

p:packston

p/G:packston grainston

G:grainston

D:dolston

w/p:wackston packston	Shoal	lagoon	for slop
p:packston	open marin	bioherm	
p/G:packston grainston			
G:grainston			
D:dolston			

Conclusion

This study was conducted for the environmental impact of sedimentation on the facies of the Mishref formation by analyzing the thin slices of the wells (zb-199,zb-43,zb-47), and the following conclusions can be drawn: -

1- By analyzing the thin rocky slices, the facies that make up the Mishrif formation were identified, It consists of seven main facies and nineteen secondary facies deposited in five sedimentary environments, which the open marine environment, the for slop environment, the Rudist Bioherm Environment , Shoal Environment , Lagoon Environmnet
2- The petrographic study showed that the main skeletal granules in Mishrif formation include benthic foraminifera, algae, corals, and echinoderms. The planickton foraminifera is common in the lower part of the Mishrif formation, while the non-skeletal granules include the peloidal.
3- Diageneses processes that affect the deposits of the Mishrif formation are dissolution and cementation, recrystallization, compaction, dolomite and micritization. Some of these processes work to improve the quality of the reservoir for the formation of Mishrif formation, such as dissolution and dolomitization, while other transformational processes have a negative impact on the petrophysical properties of the formation. Moderator, such as the process of obesity and recrystallization.

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